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(54) DEVICE FOR ULTRASONIC DISPERSION OF A LIQUID MEDIUM.

(57) A device for ultrasonic dispersion of a liquid medium comprises an ultrasonic radiator (1) with a concentrator (2), a main (3) and a subsidiary (6) support bushing mounted, respectively on the ultrasonic radiator (1), on the concentrator (2) and on its end part (4). The main support bushing (3) is kinematically connected to at least two sleeves (8,9,10) for feeding the liquid medium, each of them

being connected to a corresponding hollow rod (20,21,22) connected to a corresponding radial channel (23,24,25) of the subsidiary bushing (6), and to a valve (33,34,35) for regulation

of the liquid medium flow mounted on the subsidiary support bushing (5).

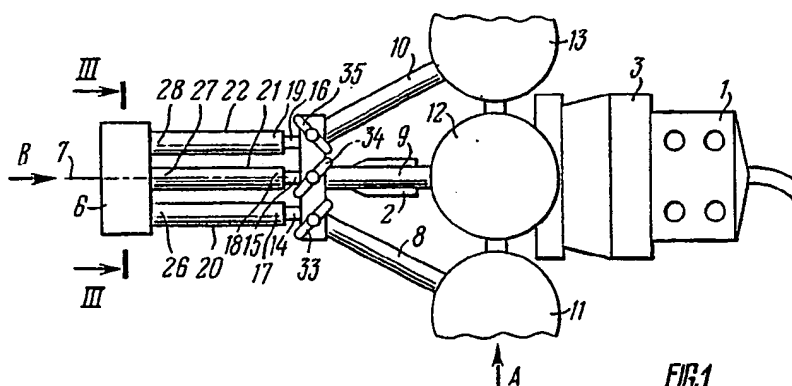


FIG. 1

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## Field of the Art

This invention relates generally to devices for atomizing liquids, and more particularly to an apparatus for ultrasonic atomization of liquids.

## Prior Art

Modern industrial processes associated with applying liquids to workpiece surfaces call for obtaining a range of high-quality aerosols and mist sprays of various compositions.

Most advanced are devices for ultrasonically atomizing liquids as such devices do not require heating the liquids during atomization.

There is known an apparatus for ultrasonic atomization of liquids (cf., SU, A, 1,237,261) comprising an ultrasonic radiator, a concentrator, a main bearing sleeve secured on the ultrasonic radiator, an additional bearing sleeve secured on the concentrator, and auxiliary bearing sleeve having a radial passage in its body with an outlet hole at its inner surface and mounted at the end portion of the concentrator, a tube for feeding the liquid extending along the geometrical longitudinal axis of the concentrator, mechanically connected to the main bearing sleeve and having a free end thereof passed through the body of the additional bearing sleeve, a hollow rod one end of which movably receives the free end of the tube for feeding the liquid, the other end communicating with the inlet hole of the radial passage of the auxiliary bearing sleeve, and a valve for controlling the feed of the liquid mechanically connected to the pipe for feeding the liquid.

However, this apparatus ensures atomization of only homogeneous liquids, which limits the range of its application.

Another disadvantage of this prior art apparatus is leak of the liquid resulting in excessive consumption thereof.

## Disclosure of the Invention

It is an object of the present invention to provide an apparatus for ultrasonic atomization of liquids having such additional members that would render the apparatus capable of atomizing two or more heterogeneous liquids accompanied by their mixing.

The object of the invention is attained by that in an apparatus for atomizing liquids comprising an ultrasonic radiator with a concentrator, a main bearing sleeve mounted on the ultrasonic radiator, an additional bearing sleeve secured on the concentrator, an auxiliary bearing sleeve secured at the

end portion of the concentrator and having a radial passage in its body with an outlet hole at its inner surface, a tube for feeding the liquid extending along the geometrical longitudinal axis of the concentrator, mechanically connected to the main bearing sleeve, and having a free end thereof passed through the body of the additional sleeve, a hollow rod one end of which movably receives the free end of the pipe for feeding the liquid, whereas the other end communicates with the inlet hole of the radial passage of the auxiliary bearing sleeve, and a valve for controlling the feed of the liquid mechanically connected to the pipe for feeding the liquid, according to the invention, the apparatus is provided with at least one more additional tube for feeding the liquid extending along the geometrical longitudinal axis of the concentrator, mechanically connected to the main bearing sleeve, additional hollow rods equal in number to the number of the additional tubes for feeding the liquid, one end of each such rod movably receiving a free end of the corresponding additional tube for feeding the liquid, and additional valves for controlling the feed of the liquid, each such valve being connected to the corresponding additional tube for feeding the liquid, whereas the body of the auxiliary bearing sleeve has additional radial passages equal in number to the number of the additional hollow rods, the inlet hole of each such additional radial passage communicating with the other end of the corresponding additional hollow rod, the outlet hole being arranged at the inner surface of the auxiliary bearing sleeve.

Preferably, the surface of the end portion of the concentrator is provided with grooves equal in number to the number of tubes for feeding the liquid, the auxiliary bearing sleeve being preferably so positioned that each of the grooves of the concentrator communicates with the outlet hole of its corresponding radial passage.

Favourably, each groove of the concentrator extends along its geometrical longitudinal axis.

Adviseably, each groove of the concentrator extends about a helical line.

Advantageously, each valve for controlling the feed of the liquid is disposed in the body of the additional bearing sleeve.

The invention affords simultaneous mixing and atomization of heterogeneous liquids in one phase to result in a wider application range of the apparatus.

Also, the invention allows to control the flow rate of each of the liquids being mixed.

In addition, the invention makes it possible to meter-feed the liquids.

## Summary of the Drawings

The invention will now be described in greater detail with reference to various preferred embodiments thereof taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a general view of an apparatus for ultrasonic atomization of liquids according to the invention;

Fig. 2 is a section taken along the arrow A in Fig. 1;

Fig. 3 is a section taken along the line III-III in Fig. 1 showing schematically radial passages;

Fig. 4 is an enlarged view of unit C in Fig. 2; and

Fig. 5 is an enlarged view of the end portion of a concentrator with grooves extending about a helical line.

#### Preferred Embodiment of the Invention

An apparatus for ultrasonic atomization of liquids comprises an ultrasonic radiator 1 (Fig. 1) with a concentrator 2 (Figs. 1, 2). The radiator 1 carries a main bearing sleeve 3, whereas provided at the concentrator 2 and at its end portion 4 are additional and auxiliary bearing sleeves indicated by 5 and 6, respectively. Arranged along the geometrical longitudinal axis 7 of the concentrator 2 are three tubes 8, 9, 10 (Fig. 1) for feeding the liquid, each such tube communicating with a respective vessel 11, 12, 13 containing liquids. The tubes 8, 9, 10 (Fig. 2) rest on the main bearing sleeve 3. Free ends 14, 15, 16 (Fig. 1) of the respective tubes 8, 9, 10 extend through the body of the sleeve 5, and are adapted to movably enter ends 17, 18, 19 of the corresponding hollow rods 20, 21, 22. The body of the sleeve 6 has three radial passages 23, 24, 25 (Figs. 2, 3) with the inlet hole of each such passage communicating with another end 26, 27, 28 of the corresponding hollow rod 20, 21, 22, their outlet holes being provided at an inner surface 29 of the sleeve 6. The end portion 4 of the concentrator 2 has grooves 30, 31, 32 (Figs. 3, 4) extending along its axis 7 and equal in number to the number of tubes 8, 9, 10 (Fig. 1), each such groove communicating with the outlet hole of the corresponding passage 23, 24, 25 (Figs. 3, 4) of the sleeve 6. Secured in the body of the sleeve 5 (Fig. 1) are three valves 33, 34, 35 for controlling the flow rate of the liquid, each such valve communicating with the respective tube 8, 9, 10.

According to another embodiment of the concentrator 2 of the apparatus for ultrasonic atomization of liquids, each groove 36, 37, 38 (Fig. 5) at its end portion 4 extends about a helical line. Otherwise, this construction of the concentrator 2 is similar to one described with reference to Figs. 1 and 2.

The proposed apparatus for ultrasonic atomization of liquids operates in the following manner.

Signals generated by an ultrasonic generator (not shown) are conveyed to the ultrasonic radiator 1 (Figs. 1, 2) to induce ultrasonic oscillations therein.

From the radiator 1 the oscillations are transmitted to the concentrator 2 to be emitted from its end portion 4. At the same time, the liquids, such as liquids of different properties, are conveyed from the vessels 11, 12, 13 along the tubes 8, 9, 10 to the portion 4 of the concentrator 2. According to one specific feature of the invention, the use of several tubes 8, 9, 10 affords atomization of such unlike liquids which are preferably not to be mixed together prior to atomization.

When it is necessary to mix different liquids, the valves 33, 34, 35 (Fig. 1) act to control the feed of such liquids along the tubes 8, 9, 10 in preferred proportions. This arrangement of the valves 33, 34, 35 allows to increase the field of vision of the surface being treated and makes the apparatus more convenient in handling. The liquids flow from the tubes 8, 9, 10 and along the corresponding hollow rods 20, 21, 22 to the radial passages 23, 24, 25 (Fig. 3) of the auxiliary bearing sleeve 6. From the outlet holes of the passages 23, 24, 25 the liquids are conveyed to the corresponding groove 30, 31, 32 (Figs. 3, 4) of the concentrator 2. This feature of the invention prevents leaks of the liquids and excessive consumption rate thereof during atomization.

Arrangement of the grooves 30, 31, 32 (Fig. 5) of the concentrator 2 about a helical line allows to intensify the atomization process.

The present invention makes it possible to simplify operation of the apparatus.

In addition, the invention affords a saving in the consumption of liquids being atomized.

#### Industrial Applicability

The invention can be used for obtaining aerosols and mist sprays, for example, when applying liquids to various surfaces.

The invention can also find application in internal combustion engines, fuel injectors, and the like.

#### Claims

1. An apparatus for ultrasonic atomization of liquids comprising an ultrasonic radiator (1) with a concentrator (2), a main bearing sleeve (3) mounted on the ultrasonic radiator (1), an additional bearing sleeve (5) secured on the concentrator (2), an auxiliary bearing sleeve (6),

secured at the end portion (4) of the concentrator (2) and having a radial passage (24) in its body with an inlet hole at its inner surface, a tube (9) for feeding the liquid extending along the geometrical longitudinal axis (7) of the concentrator (2), mechanically connected to the main bearing sleeve (3), and having a free end (15) thereof passed through the body of the additional sleeve (5), a hollow rod (21) one end (18) of which movably receives the free end (15) of the pipe (9) for feeding the liquid, whereas the other end (27) communicates with the inlet hole of the radial passage (24) of the auxiliary bearing sleeve (6), and a valve (34) for controlling the feed of the liquid mechanically connected to the pipe (9) for feeding the liquid, characterized in that the apparatus is provided with at least one more additional tube (8, 10) for feeding the liquid extending along the geometrical longitudinal axis (7) of the concentrator (2), mechanically connected to the main bearing sleeve (3), additional hollow rods (20, 22) equal in number to the number of the additional tubes (8, 10) for feeding the liquid, one end (17, 19) of each such rod movably receiving a free end (14, 16) of the corresponding additional tube (8, 10) for feeding the liquid, and additional valves (53, 35) for controlling the feed of the liquid, each such valve being connected to the corresponding additional tube (8, 10) for feeding the liquid, whereas the body of the auxiliary bearing sleeve (6) has additional radial passages (23, 25) equal in number to the number of the additional hollow rods (20, 22) the inlet hole of each such additional radial passage communicating with the other end (26, 28) of the corresponding additional hollow rod (20, 22), the outlet hole being arranged at the inner surface of the auxiliary bearing sleeve (6).

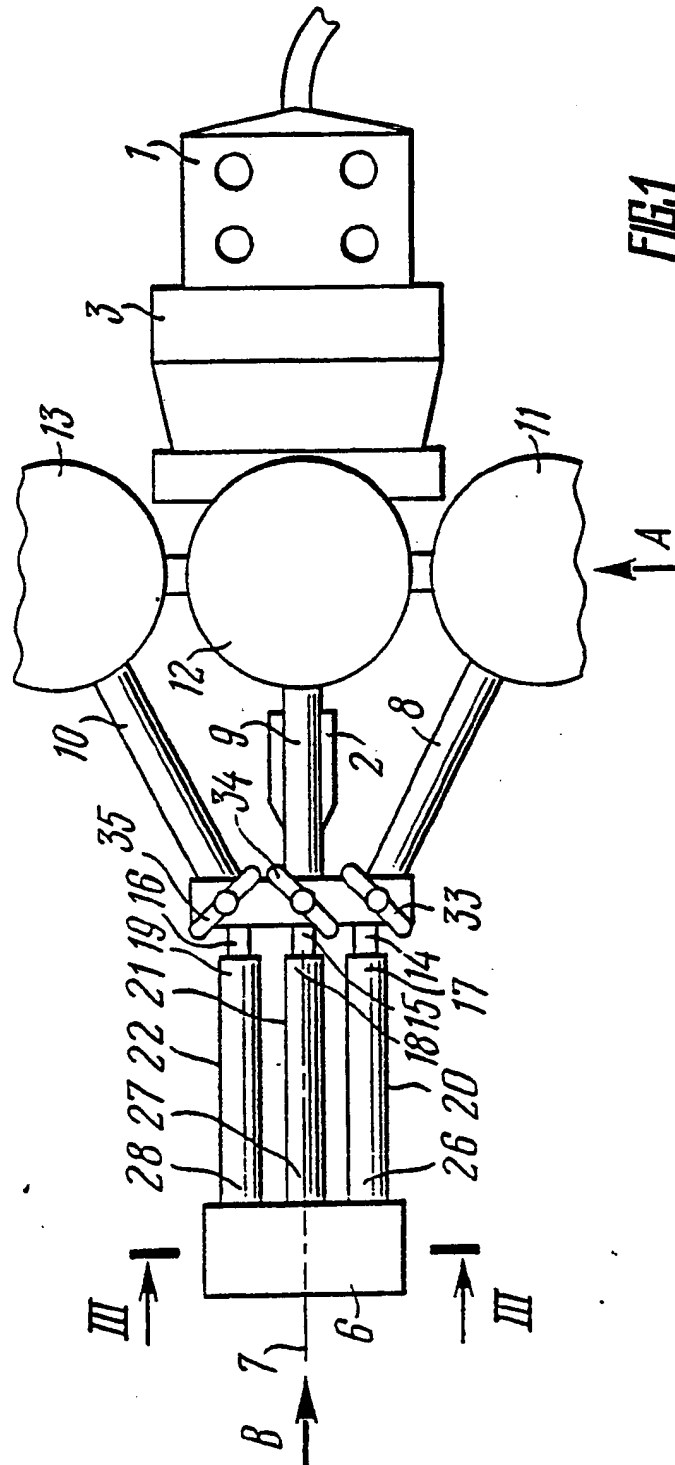
2. An apparatus as defined in claim 1, characterized in that the surface of the end portion (4) of the concentrator (2) is provided with grooves (36, 37, 38) equal in number to the number of the tubes (8, 9, 10) for feeding the liquids, the auxiliary bearing sleeve (6) being so positioned that each of the grooves (36, 37, 38) of the concentrator (2) communicates with the outlet hole of its corresponding radial passage (23, 24, 25).

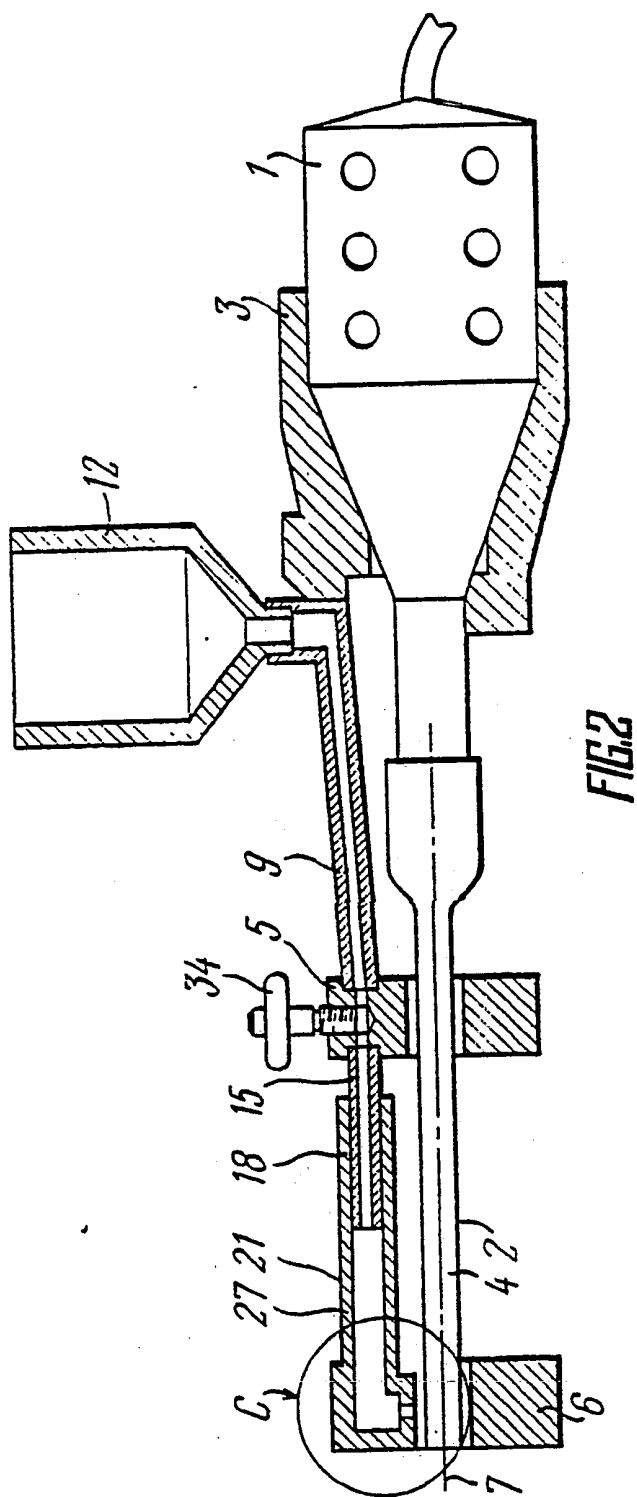
3. An apparatus as defined in claim 2, characterized in that each groove (36, 37, 38) of the concentrator (2) extends along its geometrical longitudinal axis (7).

4. An apparatus as defined in claim 2, character-

ized in that each of the grooves (36, 37, 38) of concentrator (2) follows a helical line.

5. An apparatus as defined in claim 1, characterized in that each valve (33, 34, 35) for controlling the feed of the liquid is disposed in the body of the additional bearing sleeve (5).





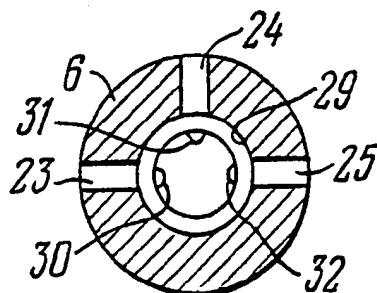


FIG. 3

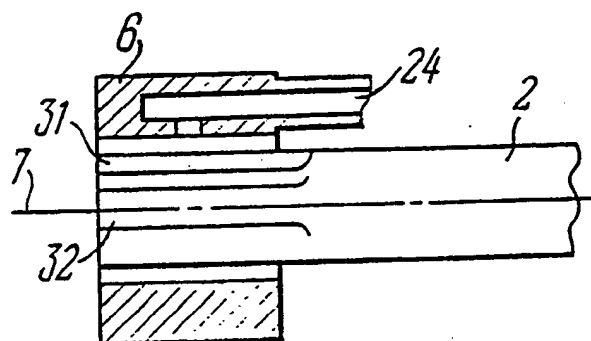


FIG. 4

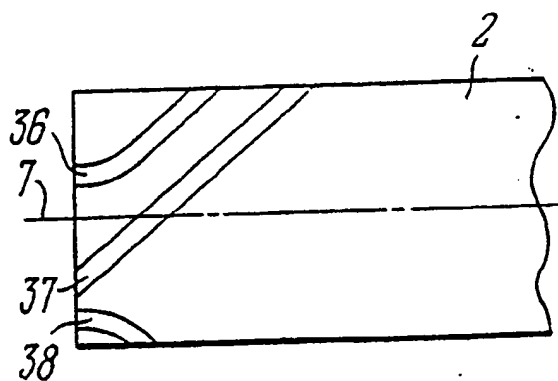


FIG. 5

# INTERNATIONAL SEARCH REPORT

International Application No PCT/SU 89/00078

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) *		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int.Cl. <sup>5</sup> - B05B 17/06		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
Int.Cl. <sup>4</sup>	B05B 17/06	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>9</sup></b>		
Category <sup>10</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
A	SU, A1, 1412816 (KAUNASSKY POLITEKHNICHESKY INSTITUT IM. ANTANASA SNECHKUSA), 30 July 1988 (30.07.88)	1
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A	GB, A, 2073616 (BATTELLE-INSTITUT e.V), 21 October 1981 (21.10.81), see the claims, figure 1-17	1
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A	US, A, 4726525 (TOA NENRYO KOGYO KABUSHIKI KAISHA), 23 February 1988 (23.02.88), see the claims, figure 1-7	1
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<p>* Special categories of cited documents: <sup>10</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
1 November 1989 (01.11.89)	6 December 1989 (06.12.89)	
International Searching Authority	Signature of Authorized Officer	
ISA/SU		